Certified Level 1 Validation Report, Part A: Validator Provided Details

Validator Provided

Audit Information:

Water Supplier Name: Pasadena Water & Power **PWS ID:** CA1910124

System Type: Potable **Audit Period:** CY 2020

Utility Representation: Tony Estrada, City of Pasadena Engineer

Validation Date: 9/30/2021 **Call Time:** 14:30 **Sufficient Supporting Documents Provided:** Yes

Validation Findings & Confirmation Statement:

Key Audit Metrics:

Data Validity Score: 67 **Data Validity Band (Level):** Band III (51 – 70)

ILI: 2.32 **Real Loss:** 38.23 (Gal/conn/day) **Apparent Loss:** 22.43 (Gal/conn/day)

Non-revenue water as percent of cost of operating system: 7.1%

Certification Statement by Validator:

This water loss audit report has been Level 1 validated per the requirements of California Code of Regulations Title 23, Division 2, Chapter 7 and the California Water Code Section 10608.34.

All recommendations on volume derivation and Data Validity Grades were incorporated into the water audit. ☒

If not, rejected recommendations are included here.

Validator Information:

Water Audit Validator: Justin Bailey, via Rubio Cañon Land and Water Association

Qualifications: Water Audit Validator Certificate issued by the CA-NV Section of the AWWA

Certified Level 1 Validation Report, Part B: Utility Provided Details

Utility Provided

Audit Information:

Water Supplier Name:	Pasadena Water & Power
Water Supplier ID Number:	CA1910124
Water Audit Period:	CY 2020

Water Audit & Water Loss Improvement Steps:

- PW&P conservation program team is piloting the "Flume" leak detection device, which is a water sensor that straps onto a customer's water meter. Real time waste usage data is transmitted to the Flume Bridge via the cloud and provides the customer with real time water usage on their smart phone, and notifies of leaks across the entire property.
  - PWP is currently testing this device and will be piloting it for a sample of residential customers.
- This year PWP launched a rebate for flow monitoring devices for residential customers, to assist them in identifying leaks and decreasing water loss. PWP has included this rebate offering on its webpage and all collateral, and will be monitoring participation levels. PWP plans to ramp up additional outreach regarding the rebate for Fix-a-Leak Week in Spring 2022.
- PWP is also piloting a leak detection device for Multifamily properties, and is in the process of executing a contract with Sensor Technologies.

Certification Statement by Utility Executive:

This water loss audit report meets the requirements of California Code of Regulations Title 23, Division 2, Chapter 7 and the California Water Code Section 10608.34 and has been prepared in accordance with the method adopted by the American Water Works Association, as contained in their manual, *Water Audit and Loss Control Programs, Manual M36, Fourth Edition* and in the Free Water Audit Software version 5.

Executive Name (Print)	Executive Position	Signature	Date
Brad Boman	Engineering Manager	Brad Boman	10-1-2021

Pre-Interview Notes	Pasadena Water and Power is a not-for-profit public service owned and operated by the City of Pasadena for the benefit of its customers and the community. The distribution system server more than 37,000 active metered connections and supplied more than 29,000 Acre Feet of water in 2020. 61.5% of that volume was imported from MWD, and 38.5% of overall production was supplied by Pasadena owned and operated wells and facilities. Preliminary information and supporting documentation necessary to perform this validation was provided 9/17/2020. Supplemental data provided and Interview conducted between 9/12/2021 and 9/30/2021. All information requests were met and all provided information was detailed and specific.	
Audit Input	**Confirmation of Input Derivation**	**Confirmation of DVG Assignment**
Volume from Own Sources (VOS)	**Supply meter profile:** Water entering the system is comprised of combined flows of (18) wells and (5) MWD imported water connections. **VOS Input Data Source:** Meter registers are manually on a weekly basis and flows are tracked real time via SCADA. Produced volumes are recorded monthly and annually. **Comments:** 38.5% of Water Supplied was from 10 of the 18 ground water production wells. 8 production Wells were not utilized in CY2020. The meters for each operational Well are tested volumetrically on an annual basis. All but 1 VOS production meter under-registered during annual volumetric accuracy tests. **Confirmed input value: 11,229.969 AF**	**Percent of VOS metered:** 100% **Signal calibration frequency:** Reactive, following observed discrepancy between mechanical meter and SCADA flow. **Volumetric testing frequency:** Annual **Volumetric testing method:** Timed flow through test meter or pitot tube method **Percent of VOS tested and/or calibrated:** 100% Volumetric, 0% Signal Calibration **Comments:** The volumetric testing occurs annually and procedures are well known by staff. **Confirmed DVG: 7**
VOS Master Meter Error Adjustment	**Adjustment Basis:** Pump Check annual volumetric testing reports **Net Storage Change Included:** No. **Comments:** Pasadena W&P conducts regular volumetric testing of each operational well on an annual basis. Meter inaccuracy applied to each volume each month for each connection to calculate specific volume adjustments per meter. **Confirmed input value: -98.020 AF**	**Supply meter read frequency:** Meter registers are physically read each week and daily while running. SCADA tracks this data hourly **Supply meter read method:** Manual **Frequency of data review:** Weekly **Storage level monitoring frequency:** Hourly **Comments:** Known meter accuracy (%) is applied to each recorded monthly registered volumes to calculate highly accurate actual volume produced by each well. **Confirmed DVG: 3**

Water Imported (WI)	**Import meter profile:** Imported water is supplied by MWD through (5) separate metered connections. (2) of the (5) MWD Connections (P-2 Sierra Madre & P-4 Jones) were not used to deliver any water in CY2020 **WI Data Source:** Meter registers are read weekly and flows are recorder by SCADA in real time. Production reports track cumulative production on a monthly basis throughout the year. **Comments:** 61.5% of total water supplied was imported **Confirmed input value: 18,108.428 AF**	**Percent of WI metered:** 100% **Signal calibration frequency:** Annually **Volumetric testing frequency:** Unknown **Volumetric testing method:** Unknown **Percent of WI tested and/or calibrated:** Volumetrically: Unknown. Signal Calibration: 100% completed annually **Comments:** MWD performs annual signal calibration of all (5) of their imported water meters annually. **Confirmed DVG: 7**
WI Master Meter Error Adjustment	**Adjustment Basis:** N/A **Comments:** No adjustment made due to no volumetric testing performed on the WI meters by the wholesaler (Metropolitan Water District). However, Signal Calibration testing was performed to assure remote monitoring tightly matched meter volume totalizer. **Confirmed input value: 0.00 AF**	**Import meter read frequency: Manually** weekly, SCADA full time **Import meter read method:** Manual + Remote (SCADA) **Frequency of data review:** Monthly **Comments:** Signal Calibration testing was performed to assure remote monitoring tightly matched meter volume totalizer. Verbal confirmation provided by Wholesaler (MWD) but no reports or "Adjusted" metered totals provided. MWD would adjust billing if gross error were detected via calibration testing. **Confirmed DVG: 5**
Water Exported (WE)	**Export meter profile:** Metered interconnections with several agencies + Direct Billed connections with South Pasadena. **WE Data Source:** Reporting spreadsheet provided with monthly volumes exported & billed. **Comments:** None **Confirmed input value: 55.384 AF**	**Percent of WE metered:** 100% **Signal calibration frequency:** None performed **Volumetric testing frequency:** Not practiced **Volumetric testing method:** N/A **Percent of WE tested and/or calibrated:** None **Comments:** No testing of WE meters is currently conducted **Confirmed DVG: 3**

WE Master Meter Error Adjustment	**Adjustment Basis: N/A** **Comments:** Left blank for lack of test data **Confirmed input value: N/A**	**Export meter read frequency:** N/A **Export meter read method:** N/A **Frequency of data review:** N/A **Comments:** None **Confirmed DVG: N/A**
Billed Metered Authorized Consumption (BMAC)	**Customer Meters & Reads Profile:** Customer meters composition is the same as last year with residential Single family (75%), Residential Multi-Family (12%), Commercial (13%), and City (<1%). Meters are electronically read on a monthly basis for billing and consumption totals. - **Age profile:** Oldest meters are 10 - 15 years old. The entire system was upgraded to new meters with AMR radio registers. Average age reported at 10 years old - **Reading system:** AMR electronic read with computerized billing software - **Read frequency:** Monthly **Billing Data Pro-rated?** Yes, in the event of meter failure. The corresponding month from the previous years is used to best inform estimated usage. **Comments:** Detailed report with cumulative breakdown of all customer accounts and class provided by Pasadena W&P. Includes all PWP customer metered consumption of 26,688.140 AF. Does not include water "exported" to South Pasadena. **Confirmed input value: 26,688.140 AF**	**Percent of customers metered:** 100% **Small meter testing policy:** Reactive meter testing based on customer requests or complaints. 3rd party conducts removal and bench testing of selected meters; not insitu. **Number of small meters testing/year:** Quantity not provided. Estimated as "very limited". **Large meter testing policy:** Reactive meter testing based on customer requests or complaints via 3rd party removal & testing **Number of large meter tested/year:** Unknown **Meter replacement policy:** Yes. Meter replacement is performed annually and quantity is set by "Meter Shop" as a meter reaches 10 years old **Number of replacements/year:** 374 meter replacements reported (1.0% of meter population replacement goal) in CY2020 **Billing data auditing practice:** Meter reads are electronically entered. Billing software generates consumption and flags inconsistent usage. Billing totals are audited in-house monthly and by a 3rd party annually. **Comments:** Meter testing only occurs under limited conditions; however, Pasadena dedicates a departmental team towards focused and ongoing meter replacement. **Confirmed DVG: 6**
Billed Unmetered Authorized Consumption (BUAC)	**Billed Unmetered Profile:** No BUAC reported or identified. **Input Derivation:** N/A **Comments:** No estimated billing. **Confirmed input value: N/A**	**Policy for metering exemptions:** Strict policy for approval and invoicing are in place. **Comments:** None **Confirmed DVG: N/A**

Unbilled Metered Authorized Consumption (UMAC)	**Unbilled Metered Profile:** Water Facilities and intra-department usage report **Input Derivation:** "Revenue and Usage by Customer" spreadsheet **Comments:** monthly totals provided for verification and validation. **Confirmed input value: 13.547 AF**	**Policy for billing exemptions:** Strict policy for approval and tracking are in place. All UMAC connections are read from reliable meters and recorded monthly. **Comments:** None. **Confirmed DVG: 10**
Unbilled Unmetered Authorized Consumption (UUAC)	**Unbilled Unmetered Profile:** Services such as public works, street sweepers, and fire department utilize unmetered connections. **Input Derivation if Estimated:** known but incomplete records of approved unmetered water use. **Comments:** Flushing volumes & frequency greatly reduced during Ca. drought. Revised Default of 0.25% x AC utilized as per instruction for FWAS V6 WAV Certification. **Confirmed input value: 66.720 AF**	**Default or Adjusted Default Applied:** 0.25% x AC used to calculate UUAC. **Completeness of Documentation:** Documentation is incomplete and thus far based on infrequent occurrences and calculated estimates. **Comments:** All fire flow volumes and hydrant flushing are monitored and calculated by time and flow formulae to minimize UUAC volumes. **Confirmed DVG: 5**
Unauthorized Consumption (UC)	**Default Applied?** Yes **Input Derivation if Customized:** N/A **Comments:** Default input of 0.25% WS is applied **Confirmed input value: 73.453 AF**	**Instances and extent of UC documented:** Instances are known to have occurred historically, and each instance is investigated. No instances of UC were reported in CY2020. **Comments:** An auditable form was created as a recommendation of last year's Validation for continuous documentation and future reference. Residents identified taking unmetered water would be billed directly via estimates and added to (BMAC) Water trucks & construction companies would be tracked and recorded as UC (non-revenue) volumes. **Confirmed DVG: 5**

Customer Metering Inaccuracies (CMI)	**Input Derivation:** See BMAC activities for meter testing and replacement practices. Meter accuracy estimated on average meter age of 10 years. **Comments:** Good record keeping and tracking exists and entire system has been converted to AMR technology. Replacement is balanced between reactive and proactive replacements. 374 meters were replaced (1.0% of total active service count) **Confirmed input value: (3.0%) 825.825 AF**	**Characterization of meter testing:** Limited proactive meter testing is reported to take place annually. However, a total test quantity for 2020 was unable to be provided. Unable to determine if greater than 1% of inventory (374 meters) tested in 2020. **Characterization of meter replacement:** Dedicated field crew conducts meter replacements based on age, failure, and customer complaints. **Comments:** Limited meter testing is reported to occur each year, but no quantity was provided. Consumption estimates cannot be confirmed to be based on testing results. **Confirmed DVG: 3**
Systematic Data Handling Errors (SDHE)	**Input Derivation:** AMR + Computerized billing software and reporting is in place. In house audits of data occur monthly and a 3rd party auditor review takes place annually. **Comments:** Oversight and auditing of account data is standardized, with regularly corrected totals applied each month for consumption and billing accuracy. Billing software is capable of generating multiple reports and queries including in/out water balance. Utilized default volume (0.25% BMAC), but scored DVG 6 due to higher features of computerized billing / accounting system with regular internal audits performed **Confirmed input value: 66.720 AF**	**If custom estimate provided –** Default input volume applied **Characterization of read collection & billing process:** Electronic meter reading with AMR is employed throughout the system and reading occurs on a monthly basis **Characterization of billing process and billing data auditing:** Computerized billing software with In house review of data performed monthly and 3rd party audits performed annually. **Confirmed DVG: 6**
Length of Mains	**Input Derivation:** Hydraulic Model and regularly updated GIS were leveraged to determine accurate distribution system data. **Hydrant lateral length included:** Yes. Overall length reported includes 11 miles of cumulative hydrant lateral lengths. **Comments:** Pasadena regularly updated hydraulic model in its overall asset management and project planning process **Confirmed input value: 532.4 Miles**	**Mapping format:** GIS database and hydraulic model **Asset management database:** Yes, relying on GIS, paper maps, and online 'Outage Map' to track and quantify leak volumes and location / proximity. **Map updates & field validation:** Engineering practices include field verification of each project after completion. **Comments:** Pasadena is not yet incorporating break history into their GIS, but other characteristics (type, section length, installation date) are incorporated. **Confirmed DVG: 7**

Number of Active and Inactive Service Connections	**Input Derivation:** Routine query from billing software to produce accurate record of accounts. Reviewed monthly and annually **Basis for database query:** Account ID, Address, or Parcel ID **Comments:** From Pasadena W&P spreadsheet inputs. Includes verified count of 38,382 Active accounts + 65 Inactive accounts **Confirmed input value: 38,447 Combined**	**CIS updates & field validation:** Accomplished through normal meter reading process and in-house audit of data **Estimated error of total count within:** 3% **Comments:** No additional comments **Confirmed DVG: 7**
Average Length of Customer Service Line	**Are customer meters at the curbstop? Yes** **Where are customer meters installed if not at curbstop?** **Customer service line derivation** **Comments:** Default input grade applied. Customer meters are typically located at the property boundary. **Confirmed input value: YES**	**Comments:** Default input grade applied. Customer meters are typically located at the property boundary. **Confirmed DVG: 10**
Average Operating Pressure	**Number of zones, general setup:** The system has 28 pressure zones and pumping facilities. **Typical pressure range:** 30 – 90 psi with average of 73.4 psi calculated by model. **Input derivation:** Hydraulic Model, SCADA, and manually taken pressure readings. **Comments:** Pressure zone integrity is tightly monitored and no valves are left in a position to breech pressure zones. Inter-zone PRV's are kept regularly maintained to further reduce the potential for pressure fluctuations. **Confirmed input value: 73.4**	**Extent of static pressure data collection:** SCADA records system pressures while pumps and wells are on or off, allowing static and dynamic pressures to be well identified. **Characterization of real-time pressure data collection:** SCADA telemetry archives real time system pressures at all pumping and storage facilities with some temporary pressure gauges capturing pressure data along the distribution system. **Hydraulic model in place?** Yes **Calibrated?:** 2016 **Comments:** Hydrant pressures are also recorded during testing / fire flows to further document static system pressures **Confirmed DVG: 5**

Total Operating Cost (TOC)	**Input Derivation:** From internal budgeting reports. **Comments:** Financial Statements and Supplementary Information provided by Pasadena including annual budget documents and annual cost auditing are in Fiscal Year format. Able to confirm all relevant costs (Salaries, benefits, insurance, depreciation, & power costs) are captured and 3rd party audited, but not directly proportionate to Calendar Year Water Supplied costs. **Confirmed input value: $60,913,049 / CY2020**	**Frequency of internal auditing:** Monthly **Frequency of third-party CPA auditing:** Annual **Comments:** Well-structured cost accounting system is in place with internal review taking place monthly, and 3rd party audit of data occurring annually. **Confirmed DVG: 9**
Customer Retail Unit Cost (CRUC)	**Input Derivation:** Calculation of annual revenues divided by 2020 water sales total. Reference 'Customer Retail Unit Cost' sheet provided by PW&P **Sewer Charges Volumetric?** N/A **Sewer Charges Included?** N/A **Comments:** Water revenue ($64,680,868.18) divided by BMAC & BUUC total (11,625,354.00 ccf) = $5.56/CCF **Confirmed input value: $5.56 / 100 Cubic Feet**	**Characterization of calculation:** Spreadsheet with audit data pulled from annual 3rd party financial report and BMAC data provided by PW&P Staff. **Comments:** Input calculations have not been reviewed by an M36 water loss expert. **Confirmed DVG: 9**
Variable Production Cost (VPC)	**Supply profile:** 38% VOS + 62% Imported from MWD. **Direct variable costs included:** Cost figure provided as is by PW&P Staff. Reported to be cost of imported water + pumping cost per unit. **Secondary costs included:** None at this time; these costs are tracked and well known but only reported on an FY basis – not directly applicable to CY water volumes. **Comments:** Cost accounting system in place with annual audits conducted by a CPA **Confirmed input value: $1,160.38 / AF**	**Characterization of calculation:** Primary costs only included. Calculation of purchased water cost + pumping cost per unit. **Comments:** Although variable costs are well known and tracked, the input calculations do not yet include liability insurance or depreciation costs. The input calculations are not reviewed by an M36 water loss expert. **Confirmed DVG: 4**

Level 1 Validation Summary Notes

Pending Items needed to complete the validation	None